

Tracking Trachoma: How The Gambia Is Eliminating an Ancient Disease

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Awa Jallow first realized that something might be wrong with her left eye several years ago when she was in her mid-20s. Her eye would tear up, and she had trouble seeing the horizon. “I was disturbed when going out into the sun,” she says. The sun was something she could hardly avoid where she lives in sunny West Africa, in an area of The Gambia not far from the capital city of Banjul. Because of her eyes, Jallow found it hard to take care of her children or to work selling firewood. So she went to her local health clinic, a busy place in the middle of a crowded market packed with vendors selling fabrics, vegetables, and fish.

The clinic’s ophthalmic nurse explained that she had a condition called trichiasis in which some of her eyelashes were growing inwards and scraping her cornea with every blink. He told her that she would need eyelid surgery to correct the condition. Without the surgery she would go blind in that eye.

Jallow’s case of trichiasis was the result of something that happened decades before—when she was a child living in a rural village, Jallow was infected with the bacterium *Chlamydia trachomatis* and developed trachoma. It takes years for trachoma’s dire effects to reveal themselves. Repeated infections in childhood

cause the eyelid to scar and turn inward many years later—as in Awa Jallow’s case.

“The more frequently you get infected and the longer [the infection lasts], the more scarring you will have,” says Hugh Taylor, a laureate professor at Australia’s University of Melbourne indigenous eye health group and a 40-year veteran in the fight against trachoma. By frequent, he does not mean every year or even every month. By one estimate, for people to have enough damage to cause turned eyelashes and blindness, they probably had at least 150 episodes of infection, most of them occurring during the first 10 years of life.¹

Trachoma is the leading infectious cause of blindness in the world.² One reason for its reign as a top eye disease is its stealth. A child who comes down with trachoma presents with common symptoms such as watery eyes and a runny nose. “When [the children] are like that all the time, it is seen as normal,” says Taylor, who still does research in the Aboriginal areas of Australia where trachoma persists.

The secretions that come from infected children’s watery eyes and runny noses contain the bacterium, which moves from child to child, spreading across entire communities via hands, fabrics, and sometimes flies in a fluid loop of infection and reinfection.



In countries where trachoma is endemic—such as Senegal, where this baby girl lives—children may have dozens of infections by age 10. The copious secretions from the eyes and nose of an infected child attract flies that spread the disease to others. Image: © RTI International.



Repeated trachoma infections scar the inside of the eyelids, causing the lashes to turn inward and scrape painfully against the eyeball. These Ethiopian patients have undergone surgery to reverse this condition, which is called trichiasis. Image: © DMA/Alamy Stock Photo.

“This is the archetypal development photo: the kids with flies on their faces,” says Matthew Freeman, an associate professor of public health at Emory University. “Flies are attracted to children with unclean faces and ocular and nasal secretions due to trachoma infection. So flies land on their faces and pass the bacteria to other children.”

In 1996, the World Health Organization (WHO) launched a program to eliminate trachoma by 2020 from the dozens of countries where it is a problem, mostly in poor parts of Africa, Asia, the Middle East, and South America.³ So far, the agency has validated five countries (Cambodia, Laos, Mexico, Morocco, and Oman) as having eliminated the disease, where elimination is defined as a reduction in the disease’s prevalence to certain levels in children and adults.^{2,4} Several other countries believe they have reached this goal and are preparing dossiers for the WHO’s approval this year or next.

The Gambia is one of them. This tiny country, which hugs the shores of the river of the same name, has a population of only about 2 million people.^{5,6} Decades of trachoma control and experimentation here are keeping children from the harmful cycle of trachoma infection and reinfection, and are helping people like Awa Jallow deal with the disease’s legacy. The Gambia’s small size and small population made it a perfect laboratory for testing new solutions to an old crisis.

Treating Trachoma throughout History

Trachoma has been a known quantity for thousands of years; references to the disease and its treatments appear in ancient

texts written by Egyptian, Greek, and Chinese scholars.⁷ But trachoma was not a concern in Western Europe until the early 19th century, when soldiers returning from the Napoleonic wars in Egypt spread the infection on a wider scale, and it took root in Europe’s crowded cities.^{7,8,9} The institution that would become London’s Moorfields Eye Hospital was founded in 1805 specifically to deal with Britain’s nascent trachoma epidemic.¹⁰



C. trachomatis, the bacterium that causes trachoma, spreads easily via hands, fabrics, and flies. Simply washing one’s hands and face plays a major role in breaking the chain of transmission. Image: © RTI International.

Trachoma also spread to the United States, where it became endemic in parts of Appalachia, the lower Midwest, and the South—a swath known as the “trachoma belt.” At the end of the 19th century, it was classified as a “dangerous contagious disease” for both medical and political reasons at a time when the government was trying to limit immigration from places like Asia and Eastern Europe. Would-be immigrants were screened for trachoma at Ellis Island and other ports of entry, and people suspected of infection would often be turned away.^{11,12}

One reason trachoma spread so widely during this period was because, while doctors may have known how to identify trachoma, they did not know what caused it or how to treat it successfully. Until the mid-20th century, doctors thought a virus caused trachoma. It is an understandable mistake because *C. trachomatis* does, in fact, act like a virus.^{8,9} Taylor explains that most bacteria grow in culture, whereas *Chlamydia* will grow only in living cells, the same as viruses. Furthermore, he says, bacteria typically replicate in minutes, while *Chlamydia* takes about a week.

Once *C. trachomatis* was confirmed as a bacterium, scientists were able to look for antibiotics to treat it. For many years, the standard treatment was tetracycline in topical ointment form applied daily for 6 weeks. But with such a long course of treatment, compliance was low.

It was only in the 1990s that an antibiotic called azithromycin became the treatment of choice, with a single oral dose of the drug as effective as 6 weeks of ointment application. That made it easier to get treatment to more people through mass drug campaigns. But even that was not a silver bullet.^{7,8,9} “There are many places where trachoma is highly endemic, and years and years of giving the drug have not led to the elimination of active trachoma,” says Paul Emerson, director of the International Trachoma Initiative. This initiative was co-founded by the drug company Pfizer, Inc., to facilitate donations of azithromycin to countries with widespread trachoma.¹³

Over the years, as some scientists searched for the best treatment options, others focused on understanding how the disease moved and how to prevent it. It was clear that trachoma is affected by socioeconomic and environmental factors such as sanitation and overcrowding. It is a disease of poverty.

In most areas of the United States and Europe, trachoma seemed to disappear on its own by the mid-20th century, before the advent of widespread antibiotic treatment, says Sheila West, a professor of preventive ophthalmology and epidemiology at Johns Hopkins University. She says that improved housing, sanitation, and access to water for personal hygiene all likely led to an interruption of transmission. In short, with development, improved living conditions, and education about personal hygiene, communities were able to break the cycle of transmission.

In 1993, the WHO started to advocate for a multipronged approach to trachoma control that combined treatment and prevention. They called it the SAFE strategy, short for surgery, antibiotics, facial cleanliness, and environmental improvement.³

The Gambian Example

The Gambia was the site of randomized controlled drug trials testing the efficacy of azithromycin.^{14,15,16} It was also, according to Emerson, a place where many of the ideas about the environmental improvement parts of the SAFE strategy were tested.

As director of the International Trachoma Initiative, Emerson now regularly speaks with health ministers about how they can eliminate trachoma in their countries, but he started his career in a much humbler way—counting and identifying flies in The



In the Upper Saloum district of The Gambia, a team led by Paul Emerson of the International Trachoma Initiative built pit latrines to deter open defecation and, possibly, the transmission of *C. trachomatis*. These latrines have four walls for privacy, no roof (Emerson explains the villagers did not like the trapped odors), and a concrete slab floor. Image: © Paul Emerson/International Trachoma Initiative.

Gambia. Emerson came to The Gambia in the late 1990s as a researcher with the UK's Medical Research Council. His background was in medical entomology, and he was conducting research that suggested a link between flies and trachoma. Emerson soon identified the possible culprit as *Musca sorbens*, an eye-seeking fly that prefers to breed in human feces.^{17,18}

Emerson wondered if improved sanitation could have an effect on the number of eye-seeking flies spreading the disease. *M. sorbens* maggots thrive in relatively dry and well-oxygenated human feces lying on the soil surface, but they are outcompeted by noncarrying fly species that prefer the wet anaerobic conditions inside a pit toilet. Less human feces on the ground would mean fewer places for *M. sorbens* to breed, and noncarrying flies would dominate.

At the time, sanitation was not well developed in The Gambia. Emerson says, “We started [our work] in villages where I can remember there not being a single toilet or pit latrine and . . . being given my kettle of water and told ‘the men go over there, and the women over there.’”

Emerson's team compared the prevalence of active trachoma in villages before and after they either began regularly spraying permethrin to control flies or were provided with pit latrines. They compared those differences to prevalence in control



These Gambian men are repairing a village well. Access to clean water is critical to controlling trachoma, as is education. “If we treat one child with active trachoma, but if they don’t have water to wash with, or if they don’t know why they should wash their face every time it’s dirty, that’s an issue,” explains Sarjo Kanyi of The Gambia’s National Eye Health Programme. Image: © Ian Patrick/Alamy Stock Photo.

villages. Villages that used the insecticide saw the greatest reduction in the prevalence of trachoma, but there also was a reduction in villages provided with new latrines.^{17,19}

Soon, nongovernmental organizations such as the Carter Center decided to make construction of latrines a central part of their trachoma control programs. But researchers doing latrine trials in other trachoma-endemic countries could not replicate the link between latrines and trachoma reduction. “My opinion is that [building latrines] was very good as a public health strategy, but did not have any particular effect on trachoma,” says West. “It was too far downstream from [the question of] how do we control ocular and nasal secretions.”

Indeed, flies are just one route of transmission. There are many others—hands, towels, clothing, and sheets. And latrines sometimes go unused because of factors like cleanliness of the latrine, habit, and ease of access. Different routes of transmission can change in importance over time depending on crowding, environmental factors, and other circumstances. In short, trachoma transmission is complicated.

Collaboration among all sectors is key, according to Sarjo Kanyi, the national program manager of The Gambia’s National Eye Health Programme. Trachoma interventions involve many doctors and scientists, but they also need the help of engineers and hydraulics specialists to improve community access to water, as well as people who can train educators on how to teach hygiene. Kanyi noted that the eye program and the Health Ministry already collaborate with the Ministry of Education to train teachers on how to educate students about face washing.

“If we treat one child with active trachoma, but if they do not have water to wash with, or if they do not know why they should wash their face every time it is dirty, that’s an issue,” says Kanyi. But it is an issue that he hopes a multi-sector approach can solve.

Reemergence, Persistence, and the Future of Trachoma

There is still work to do in The Gambia. “Even after elimination, we still have to do surveillance,” says Kanyi. The National Eye Health Programme has a protocol in place to track any cases of active trachoma and see how and where the disease moves. Kanyi says he is especially interested in monitoring the urban slums built on partially drained swamps and the crowded Koranic schools. He is also worried about cross-border infections from Senegal, which surrounds The Gambia on three sides and has a slightly higher trachoma prevalence rate.^{20,21} “In some villages, half of the village is in The Gambia and half is in Senegal,” says Kanyi. “They share services like schools and mosques, and they marry each other.”

Paul Emerson says reemergence is something to be vigilant about in the countries now declaring trachoma elimination. “In Egypt, Sudan, and Morocco in the 1950s and 1960s, they made tremendous progress [against trachoma]. Every day when a child came to school they were given a squirt of topical tetracycline into their eyes, and they practically got rid of the disease, but it persisted in a few pockets,” he explains. “It came back in each of those three countries, each of which had reached elimination.”

Morocco has eliminated trachoma once again, this time through a full implementation of the SAFE strategy.²² Emerson says the International Trachoma Initiative is keeping an eye on other programs that leaned heavily on antibiotic distribution to achieve elimination. “It is my concern that unless the environmental and hygiene aspects of the program keep pace with the expansion of the biomedical, then we are going to risk seeing the disease coming back. It will be a false horizon,” he says.

Sheila West is optimistic about The Gambia’s long-term chances, though. A study a decade ago outlined a case of reemergence in the country after residents of two villages made a pilgrimage to Senegal and came back with trachoma infections.²³ But by the time the researchers followed up at the end of the year, the prevalence of trachoma in these two villages had fallen below baseline.

“The fact that The Gambia had probably eliminated transmission, that infection came back in from Senegal but never took hold, tells us that whatever The Gambia did to reduce trachoma means it is likely not going to get reestablished,” West says. This suggests that The Gambia’s elimination is robust.

One thing working for The Gambia is its small size. West says that the whole of The Gambia would fit into one district in Tanzania where she has been working for 30 years. Progress in that Tanzanian district has been steady, and research there has been central to understanding the importance of facial cleanliness.^{24,25,26} “Most of the research now is about accelerating to get to the endgame,” she says.

Others are investigating how to tackle trachoma in places like Ethiopia, which has one of the most severe and intractable trachoma problems in the world, and where some 40% of children 1–9 years of age have active trachoma.^{27,28,29} A group led by Matthew Freeman of Emory University is currently working with the Ethiopian Ministry of Health on a scalable approach to sustain sanitation and face-washing behaviors, employing behavioral theory and rigorous formative research.

The SAFE approach is a strong strategy framework, Freeman says, but it needs to be adapted to the specific needs of each context. “We still do not have good evidence on how to prioritize promotion of water, sanitation, and hygiene, as it will depend on environmental conditions, social norms, and current practices,” he says. “We need ways to better coordinate these activities between health and the water and sanitation sectors and improve targeting towards the population most at risk for trachoma.”

Even once trachoma is gone from a country, there will still be people like Awa Jallow to treat—people who had trachoma as children and will still develop trichiasis—far into the future. Jallow herself, when faced with the prospect of going blind, decided to get the surgery on her left eye, even though some of her family and friends thought it was too risky. “But I said, ‘No, if I do not do it, I will not be able to do my work,’” she says. That was 5 years ago. Just this year, when she noticed a similar problem in her right eye, she did not hesitate to come in for another corrective surgery.

Awa Jallow not only changed her eyes, she changed her point of view. “I have become very concerned about cleanliness with my children,” she says. “When they come in, I wash their faces and their clothes.” She does not want them to experience what she went through. And maybe Awa Jallow’s generation will be the last one to suffer from this ancient scourge that has stolen the eyes and lives of so many.

Jori Lewis writes about the environment, agriculture, and international development from her perch in Dakar, Senegal. She is currently writing a book about the early history of peanuts in West Africa.

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